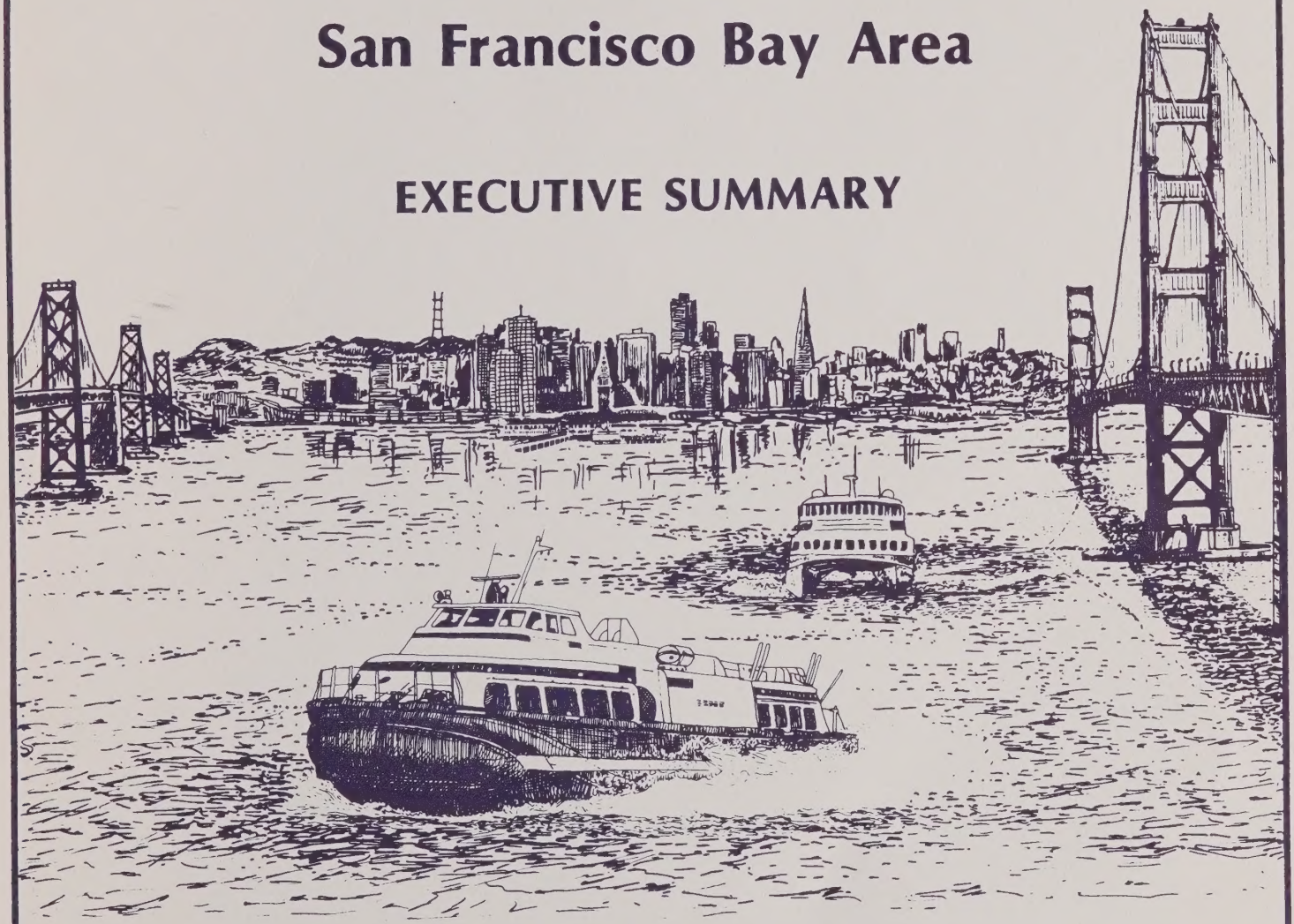
High Speed Water Transit Study for the San Francisco Bay Area

EXECUTIVE SUMMARY



MTC
METROPOLITAN
TRANSPORTATION
COMMISSION

METROCENTER
101 8TH STREET
OAKLAND, CA 94607
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April 1985

THE COVER:

Design by Michael Fram.

Depicted on the cover are two types of high speed water transit vessels that are currently operating on the San Francisco Bay. They are a Surface Effect Ship (SES) and a catamaran. A smaller version of the SES shown is being operated by Harbor Bay Isle on a 12-month demonstration project between the Harbor Bay Business Park in Alameda and San Francisco. The catamaran is being operated by Red & White Fleet between Tiburon/Sausalito and San Francisco. Not shown are the fully amphibious air cushion vehicle or the hydrofoil which are also proposed for Bay operations.

HIGH SPEED WATER TRANSIT STUDY FOR THE SAN FRANCISCO BAY AREA

EXECUTIVE SUMMARY

by

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and

Shanna O'Hare

published by

Metropolitan Transportation Commission

Planning Section

MetroCenter
101 8th Street
Oakland, CA 94607
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April, 1985

(9640P)

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MTC was created by the California State Legislature in 1970 to prepare a Regional Transportation Plan for the San Francisco Bay Area. The nine counties in this region are Alameda, Contra Costa, Marin, Napa, Santa Clara, San Francisco, San Mateo, Solano, and Sonoma.

Policy direction is provided by 18 Commissioners. Fourteen members are appointed directly by locally elected officials, two members represent other regional agencies (the Association of Bay Area Governments and the Bay Conservation & Development Commission), and two non-voting members represent state and federal transportation agencies.

EXECUTIVE SUMMARY

In July, 1984, the Metropolitan Transportation Commission (MTC) received presentations from several individuals who were proposing high speed water transit (HSWT) services on the San Francisco Bay. In response to these proposals, staff was directed to undertake a study of high speed water transit. The study commenced in August and was subdivided into six tasks:

- Overview of current HSWT technology;
- Review of existing HSWT services worldwide;
- Documentation of Bay Area water transit proposals;
- Analysis of legal and institutional considerations;
- Analysis of the Bay Area proposals;
- Preparation of a final report.

Information used in the preparation of this report consisted of the recently released 2-year study of high speed waterborne transit by the Urban Mass Transportation Administration (UMTA), supplemental data from manufacturers of HSWT vehicles, and information from the individual proposers. For the patronage projection analysis (Task 5), MTC relied on data from the 1980 Census, the Association of Bay Area Government's Projections '83, and MTC's mode choice model.

At its February 1985 meeting, the Metropolitan Transportation Commission unanimously approved the final report for this study.

I. TECHNOLOGY REVIEW

There are three primary high speed passenger vessel technologies used throughout the world: catamaran, hovercraft, and hydrofoil. Each is capable of cruising in calm water at speeds of 25 knots (28 mph) or more, approximately double the speed of conventional ferries. Figure 1 provides a schematic comparison of the three technologies. Table 1 contains a representative sample of vessels, including information on cruising speed, passenger capacity, draft, capital and operating cost and availability in the U.S. These vessels have a wide range of capital and operating costs as well as passenger capacity.

Figure 1

HIGH SPEED WATER VEHICLES

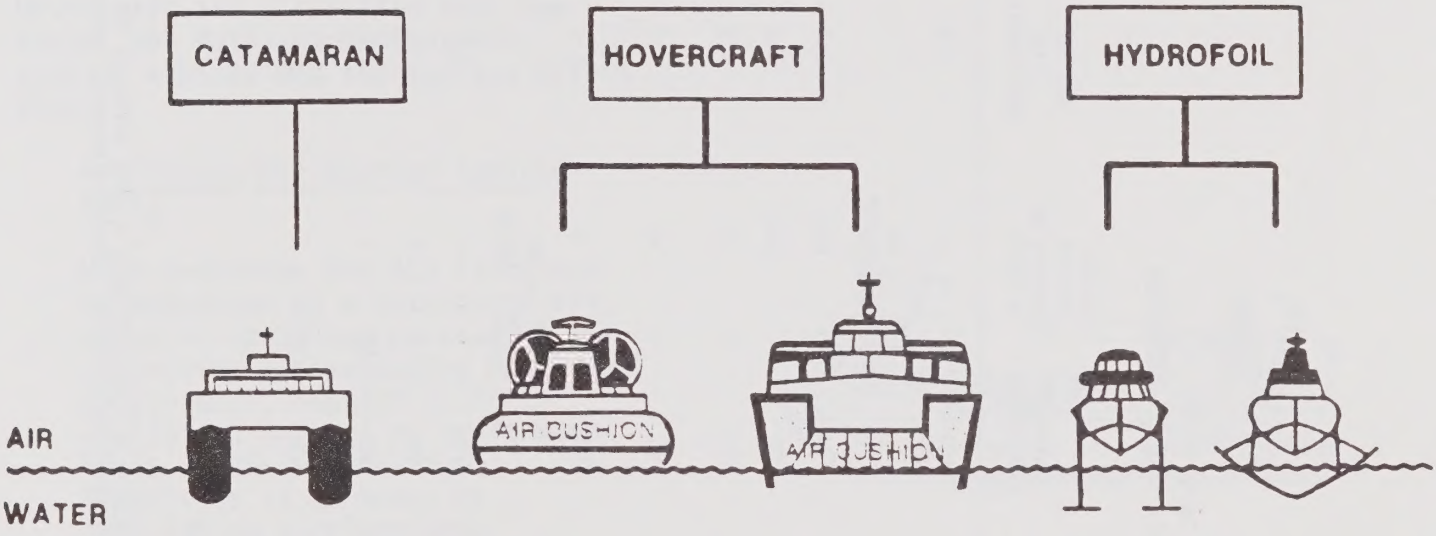


Table 1
Selected Vehicle Costs and Capacities

Vessel	Manufacturer	Model	Calm Water Cruising Speed (Knots)	Passenger Capacity	Draft Loaded (Rounded up in Feet)		Initial Cost (Millions)	Estimated[1] Operating Costs ($/Oper.Hr.)	U.S. Made
Catamaran	Nichols Brothers[b]	85'	30	400	5		1.8	120	In Production
					Off Cushion	On Cushion			
Air Cushion Vehicles	British Hovercraft[a]	AP-188	40	94	1	N/A	2.5	165	U.S. Licensee Being Sought
	RMI[b]	AVC-80	50[2]	120	1	N/A	2.5	195[2]	Awaiting an order
Surface Effect Ships	RMI[b]	SES 80	54[2]	310	6	2	4.5	220[2]	Awaiting an order
	Vosper Hovermarine[a]	HM 218	32	86	6	4	1.2	113	U.S. Licensee Being Sought
	Vosper Hovermarine[a]	HM 527	33	260	9	5	4.6	288	
					Off Foils	On Foils			
Hydrofoils									
Surface Piercing	Campbell[b]	HB 78	35-38[2]	78	8	4	1.0	69[2]	Awaiting an order
	Rodriquez[a]	RHS-70	32	69	9	4	2.0	76	U.S. Licensee Being Sought
	Rodriquez[a]	RHS-200	35	300	15	7	7.0	344	
Submerged	Boeing[a]	Jetfoil 929-115	43	423	17[3]	6	16.0	745	In Production

1) Fuel and Maintenance (crew costs not included)
2) Manufacturer's estimate; vessels not yet tested in revenue passenger service
3) Can be reduced to 7' when foils retracted

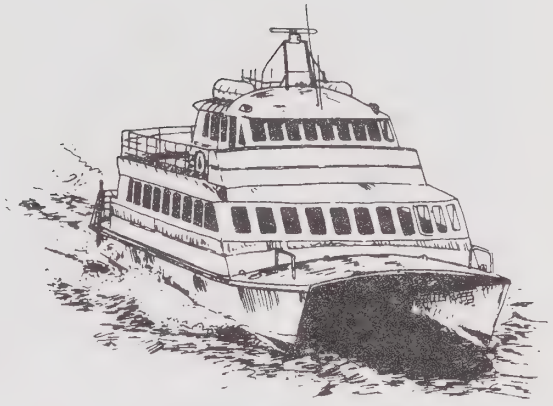
Source: (a) "Technical Memorandum, An Assessment of High Speed Waterborne Vessels & Their Builders", 1983, prepared for Urban Mass Transportation Administration, by: Advanced Marine Systems Assoc., Inc., in cooperation with Peat, Marwick, Mitchell and Company

(b) Manufacturers

(9502P)

Catamarans

The catamaran is characterized by twin hulls and interior spaciousness. These vessels are driven by diesel powered propellers. Steerage is provided by rudders. A Nichols Brothers catamaran is currently being used by Red & White Fleet to provide service between Tiburon, Sausalito and San Francisco.

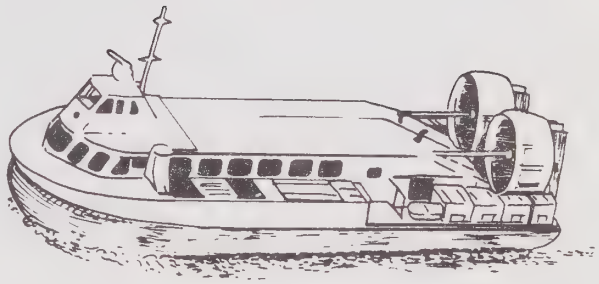


Hovercraft

Hovercraft are classified into two types, the fully amphibious air cushion vehicle and the surface effect ship.

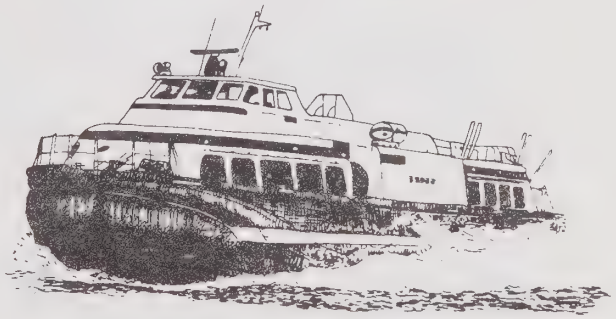
Amphibious Air Cushion Vehicle (ACV)

When underway, the ACV is raised or supported on a cushion of air, which is contained by a skirt encircling and extending below the entire hull. The ACV is fully amphibious and has no draft when it is on the air cushion. Propulsion is by means of rear-facing airplane-type propellers mounted on the deck of the craft.



Surface Effect Ships (SES)

The surface effect ship is constructed somewhat like a catamaran with two narrow hulls along the sidewalls of the vessel and a cavity between them. Underway, this craft is supported on a cushion of air contained by the solid sidewalls and flexible seals at the bow and stern. It is driven by diesel powered propellers mounted in the sidewalls, which provide steerage. At rest, the craft floats on the flat bottom between the two hulls, and the hulls extend below the waterline. A Vosper Hovermarine SES is currently being tested by Harbor Bay Isle in private service between Alameda and San Francisco.



Hydrofoils

Hydrofoils are vessels whose hulls are lifted above the water by fully submerged wings (foils) or by surface-piercing foils. Once up on their foils, these craft become high speed vessels. When off the foils, as when docking, they operate like a conventional craft. There are two vessel types: surface piercing foil (pictured) and fully submerged foil.

U.S. Made Vessels

The Merchant Marine Act of 1920, often referred to as the "Jones Act", requires vessels operating between points in the United States to be constructed in this country. Of the five vessel types discussed above, only two are currently in production in this country. Boeing Marine Systems of Seattle produces a submerged foil vessel, and Nichols Brothers of Freeland, Washington manufacturers catamarans.

Three other U.S. manufacturers claim they are equipped to build, but have not yet delivered, high speed passenger vessels for a U.S. operator. They are Bell Halter of New Orleans (surface effect ships); Campbell Shipyards of San Diego (hydrofoils); and RMI, Inc. of National City, California (air cushion vehicles and surface effect ships). Several foreign manufacturers of high speed water craft are seeking U.S. shipyards to build their vessels and are in various stages of negotiation.

II. EXISTING HIGH SPEED WATERBORNE OPERATIONS WORLDWIDE

The review of existing and recent services examined two primary topics:

- Existing high speed waterborne operations worldwide
- Bay Area waterborne passenger service

The worldwide review was based on site visits made by UMTA's consultants to 24 high speed service operators in the English Channel, Scandinavian countries, the Mediterranean, Far East, and South America. Operators selected represent the complete array of available technologies, including hovercraft, catamarans, and hydrofoils.

The Bay Area review was based on the operations of current and recent services provided by the Golden Gate Bridge District, Blue & Gold Lines, and the Red & White Fleet. It also examined the Port of Oakland Air Cushion Vehicle Demonstration of the 1960's.

The following conclusions and findings are based on the UMTA report and MTC's staff research of Bay Area services.

- Existing high speed water transit service has two predominant markets -- recreational and business trips.

- Of the operators discussed in UMTA's report, none provide primary work-related commute service or compete with an extensive highway and landside transit system, as in the Bay Area.

- High speed water transit service has been shown to be safe and reliable.

- Frequency of service appears to be the most significant factor in attracting and keeping patrons.

- High speed vessels can provide operating efficiencies by decreasing turnaround time when used in lieu of slower conventional craft.

- Operators have commonly encountered major technical problems which affect service reliability when using the first craft produced from a new design. Two years are generally required to resolve operating problems and to establish patronage levels, when using a new design.

- Of the 24 operators studied by UMTA, 20 are private companies. Many small operators are subsidiaries of larger companies and have experience in the maritime industry or public transportation.

III. BAY AREA WATER TRANSIT PROPOSALS

This section summarizes and documents the five proposals that have emerged during the course of this study. These proposals are varied in their level of detail, depending upon how far each proposal has progressed toward actual implementation, and the amount of data made available to MTC staff. Varying degrees of terminal agreements and/or construction will be required and may involve some channel dredging. In some cases the proposals are still at a conceptual stage. Exhibits 1-5 outline the proposed service, schedule, travel times/fares, vessel, scheduled service start up, and funding source.

IV. LEGAL AND INSTITUTIONAL CONSIDERATIONS

This section focuses on state and federal statutes which constitute a constraint to the implementation of high speed marine transit. The full report also includes an examination of institutional considerations, such as identification of those agencies that issue licenses and permits to water transit operators, or have jurisdiction over the Bay. The major constraint to establishment of new ferry franchises is restrictive language contained in both the California Streets and Highways Code and outstanding bonds on State toll bridges. As a result of MTC's findings, the following recommendations were approved by MTC's Legislation and Public Affairs Committee in November, 1984, and will be incorporated in MTC's 1985 State Legislative Program.

- MTC should pursue legislative amendments to the California Streets and Highways Code to remove language dating back to 1929 that restricts establishment of transbay ferry operations. (Sections 30350-30352, 30356, and 30358).

- MTC should work with Caltrans and the California Transportation Commission (CTC) to remove similar language from any new bonds on the Bay's toll bridges that restricts ferry service and to defease current bonds.

V. ANALYSIS OF WATER TRANSIT PROPOSALS

Because most of the service proposals are still in the conceptual stage, only a preliminary analysis was possible. The analysis includes a comparison of travel times and costs for different travel modes, a description of connecting

transit services, and a summary of any legal or institutional issues that could affect the proposed service. In the Sonoma/Marin and Pittsburg travel corridors, where proposers have indicated that a subsidy may be necessary, the analysis also includes rough estimates of patronage, and existing and projected population in market areas. For more information on the calculations and methodology used, see the Appendix of the final report.

This analysis is not meant to take the place of necessary feasibility studies, market analyses, and financial plans. Such steps would be a pre-requisite to successful transit service implementation, and required by MTC if subsidy is to be provided. For purposes of MTC's analysis, the proposals have been aggregated into five travel corridors. MTC's findings are presented by corridor.

Alameda to Downtown San Francisco

- Based on travel time and projected fares, HSWT apears to provide an alternative to driving alone that is both faster and cheaper.
- To operate this service, the bridge bonds must be defeased, and CTC and MTC approval is required.

Oakland Airport to San Francisco Airport

- Total travel time by HSWT is longer than most other modes in this corridor.
- Although the fare is estimated to be less than other transit alternatives, access from docking facilities to airline terminals has not been included in the cost figures.
- In the case of the hydrofoil being proposed by Forum, channel dredging will be necessary. The cost and funding source for dredging have not as yet been identified.
- To operate this service, the legislature would have to amend the Streets and Highways Code, existing bonds would have to be defeased, and the restrictive language would have to be removed from any subsequent bond covenants.

South Bay to San Francisco

- Proposed hovercraft service in the corridor would be faster but more expensive than CalTrain and slower and less expensive than the automobile.
- Access to the Alviso terminal could be a problem for patrons due to limited transit access, congested roadways, and the remote location of the terminal.
- There are no known legal barriers to this service.

Sonoma/Marin to Downtown San Francisco

- The four market areas of Santa Rosa, Petaluma, Novato, and San Rafael are estimated to have provided 2,600 daily HSWT patrons in 1980 and 4,000 in 2000.
- Santa Rosa, Petaluma, and Novato market areas may provide sufficient patronage to warrant HSWT implementation in this corridor. However, further study is necessary to detemine the cost-effectiveness of the proposed service.

- HSWT could slightly increase the total number of commuters using transit in the Santa Rosa and San Rafael areas.

- Implementation of HSWT from the mouth of the Petaluma River or another terminal in the vicinity could substantially increase transit mode split from the Petaluma market area.

- HSWT from San Rafael would likely divert patrons from the Golden Gate Bridge Larkspur Ferry without substantially increasing the total number of transit users.

- HSWT will not have a significant affect on highway congestion as the majority of patrons will be diverted from other transit modes.

- A profit-loss analysis was performed for catamaran and hovercraft service from the mouth of the Petaluma River to downtown San Francisco, and for bus service from Santa Rosa, Petaluma, and Novato to downdown San Francisco. The results of this analysis show that the estimated farebox recovery rate (revenues divided by operating costs) of the catamaran are the most favorable, although all services would operate at a deficit. Estimates of the respective farebox ratios are: 400-passenger catamaran 72%, 88-passenger hovercraft 19%, and bus 49%.

- As part of its nationwide study, UMTA analyzed a service from Larkspur to San Francisco, finding the route to be financially feasible with capital assistance using a catamaran. UMTA data indicates that hydrofoils and hovercraft are not financially feasible on this route due to the higher operating costs associated with these vessels.

- UMTA's Larkspur to San Francisco route analysis did not consider the amphibious air cushioned vehicle (AP-188) being proposed by Supervisor Roumiguiere because wave heights in the north Bay frequently exceed the three foot level. According to UMTA, passenger comfort cannot be maintained above this level in the AP-188.

- There are no known legal barriers to HSWT services in the Sonoma/Marin to San Francisco corridor.

Pittsburg/Martinez to Downtown San Francisco

- HSWT will not increase the total transit ridership.

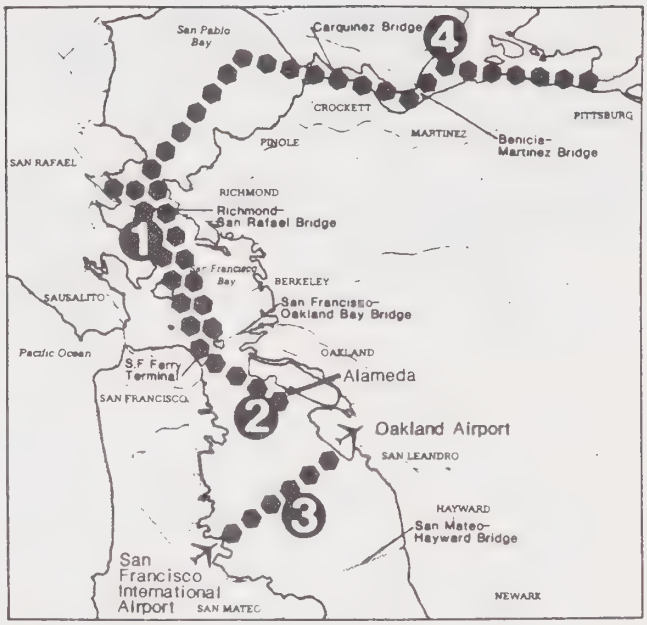
- HSWT has a higher out-of-pocket cost and longer travel time than BART.

- Implementation of HSWT in this corridor will not reduce traffic congestion on freeways near Pittsburg. Evidence suggests that most Pittsburg residents do not commute to San Francisco. The majority of commuters in the Pittsburg area commute to employment within Contra Costa County.

- Patronage estimates may be sufficient to warrant one daily round trip commute run. However, the experience of other water transit operators indicates that this level of service may not be adequate to attract and keep patronage.

- To operate this service, the legislature must amend the Streets and Highways code, existing bonds would have to be defeased, and the restrictive language would have to be removed from any subsequent bond covenants.

Exhibit 1



Proposer - Forum Hydrolines

Contact Person - Dr. Nicholas Hetzer
310 Oakview Rd.
Pleasant Hill, CA. 94523
(415) 540-8400

Operator - Forum Hydrolines operating under the name of Forhop

Routes

1	San Rafael to San Francisco.
2	Alameda to San Francisco. *
3	San Francisco Airport to Oakland Airport.
4	Pittsburg to San Francisco

Schedule - Forum Hydrolines proposes operating commute service on routes from San Rafael and Alameda to San Francisco during the hours of approximately 6:00 a.m. to 11:00 a.m. and 3:00 p.m. to 7:30 p.m. During the remainder of the day and weekends they intend to operate shopper's specials and tourist runs.

They plan to run service from San Francisco Airport to Oakland Airport at one hour headways from 6:00 a.m. to 9:00 a.m.

The proposed schedule for the Pittsburg to San Francisco service is half hour headways during the hours of 5:00 a.m. to 9:00 a.m. and 2:30 p.m. to 6:30 p.m.

Travel Times/Fares

Route	Estimated One Way Travel Time	Proposed Fares
San Rafael to San Francisco		
commuter	19 min.	$2.75
tourist		6.00
shopper		6.00
Alameda to San Francisco		
commuter	14 min.	2.25
tourist		6.00
shopper		6.00
San Francisco Airport to Oakland Airport	16 min.	8.00
Pittsburg to San Francisco	70 min.	4.00

Vessel - Surface-piercing Hydrofoil. Passenger capacity ranges from 60 to 81 passengers; the cruising speed is 35 knots; the draft is 8 feet.

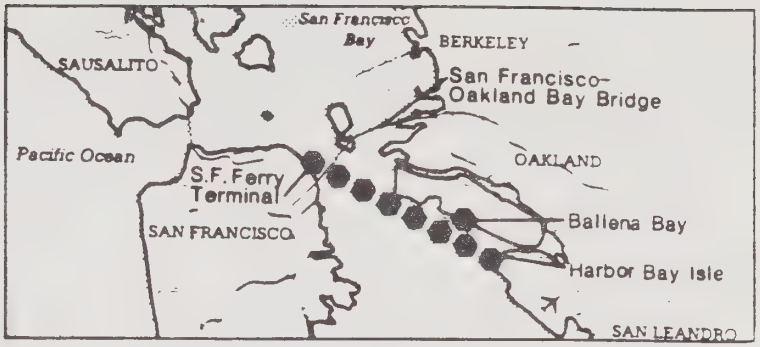
Scheduled Service Start Up - 4 to 6 months after obtaining funding.

Funding Source - Private Investors.

* Prior to issuance of the final report, Forum advised MTC staff that they no longer intend to serve Harbor Bay Isle, but will serve the City of Alameda from another point.

Proposer - Harbor Bay Isle Associates

Contact Person - Stanley M. Koweleski
Vice President Transportation Services
Harbor Bay Isle
936 Shorepoint Court
Alameda, CA. 94501
(415) 521-1771



Operator - Harbor Bay Isle Associates

Route(s)

- Harbor Bay Business Park in Alameda to San Francisco Ferry Building.
- Ballena Bay in Alameda to San Francisco Ferry Building.

Schedule - 30-minute headways during peak commute period.

Travel Times/Fares

Fares have not yet been determined.

One Way Travel Time: approximately 15 to 20 minutes, but will depend on vessel type selected.

Vessel - A decision on the exact technology has not been made. The operator is presently considering a Surface Effect Ship, model 218, by Vosper Hovermarine. A 12 month trial of this vessel commenced in October, 1984. This vessel is designed to hold 85 passengers; it has a cruising speed of 32 knots, and a 5 foot draft.

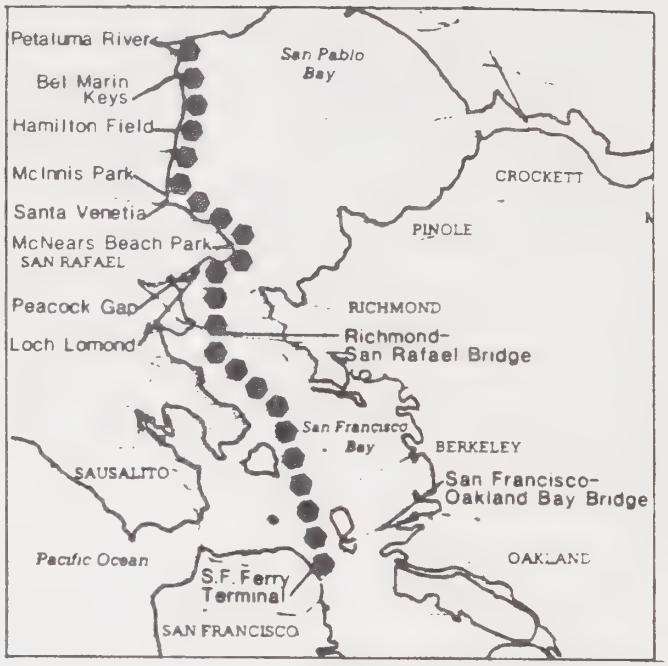
Scheduled Service Start Up - Fall, 1986

Funding Source - Harbor Bay Isle Associates; however, HBI may look to a public transit entity for financial assistance should service be extended to the general public.

Proposer - Supervisor Robert Roumiguiere

Contact Person - Supervisor Robert Roumiguiere
315 Civic Drive
San Rafael, CA. 94903
(415) 499-7331

Operator- Unknown; proposer's suggestions are Golden Gate Ferry System, a private operator, or a new regional operator



Routes

Eight potential sites along the Marin shoreline to the San Francisco Ferry Building have been identified. A market feasibility study is proposed to determine which sites are feasible:

- Petaluma River to San Francisco
- Bel Marin Keys to San Francisco
- Hamilton Field to San Francisco
- McGinnis Park to San Francisco
- Santa Venetia to San Francisco
- McNears to San Francisco
- Peacock Gap to San Francisco
- Loch Lomond to San Francisco

It is assumed that Golden Gate will continue to serve Larkspur and Sausalito to the south.

Schedule - commute service would be run during peak periods, headways would be developed through the feasibility study.

Travel Times/Fares

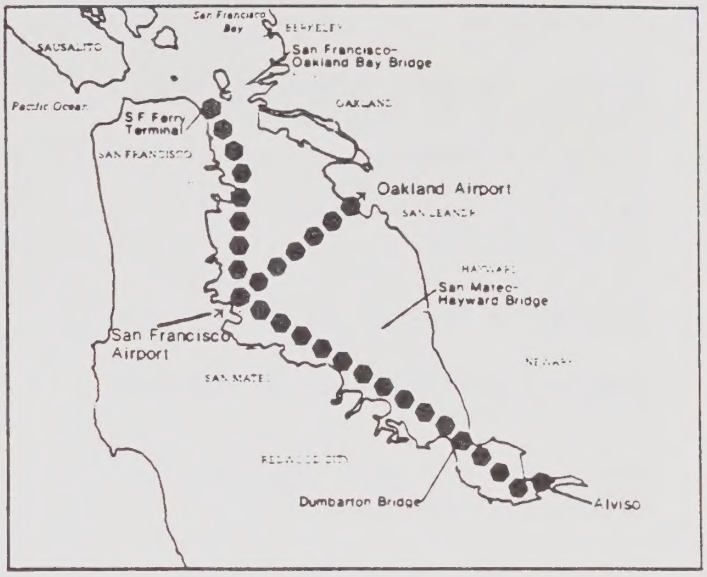
No information available.

Vessel

AP 1-88 hovercraft (British Hovercraft design) with passenger capacity of 94; 40 knot cruising speed.

Scheduled Service Start Up - no date set.

Funding Source - unknown; would depend on operating entity.



Proposer - Pacific Transportation Systems

Contact Person - John Ellis
Pacific Transportation Systems
P.O. Box 2845
Santa Clara, CA. 94055
(408) 554-7586

Operator - Pacific Transportation Systems

Routes- San Jose (Alviso) to Oakland Airport to San Francisco Airport.

Schedule - Daily service every two hours from 6:00 a.m. to midnight.

Travel Times/Fare - Information on fares was not available. Proposed one way travel times are as follows:
Alviso to downtown San Francisco - 45 minutes; Oakland Airport to San Francisco Airport - 15 minutes; San Francisco Airport to Alviso - 30 minutes.

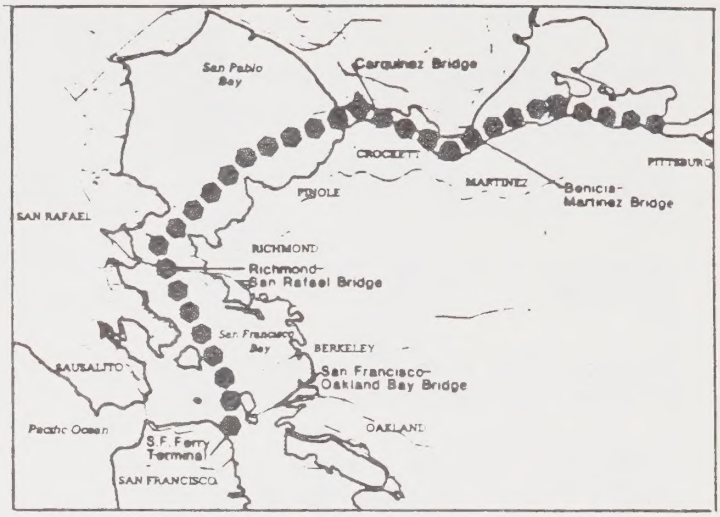
Vessel - 100 Passenger Hovercraft, the exact design and manufacturer has not been decided.

Scheduled Service Start Up - Approximately two years, given lead time necessary to negotiate licensing agreements and set up U.S. manufacturing.

Funding Source - Private Investors.

Proposer - City of Pittsburg Chamber of Commerce

Contact Person - Robert E. Jones
Executive Vice President
Pittsburg Chamber of Commerce
2010 Railroad Avenue
Pittsburg, CA. 94565
(415) 432-7301



Operator - Blue and Gold Lines, Inc.

Routes - Pittsburg to Martinez to San Francisco.

Schedule - One daily commuter run during a.m. and p.m. peak.

Travel Times/Fare - The one-way travel time is approximately one hour and 30 minutes: the proposed one-way fare is $4.00.

Vessel - Nichols Brothers 400 passenger, 85 foot Catamaran, 30 knot cruising speed, 5 foot draft.

Scheduled Start Up - Spring, 1985.

Funding Source - The catamaran being proposed for service is being purchased by Blue and Gold Lines, Inc. However, a $4.00 per passenger trip subsidy will be required to cover operating costs. The funding for this subsidy has not yet been secured.